Leopold Letter

LEOPOLD CENTER FOR SUSTAINABLE AGRICULTURE

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Evaluation measures Leopold Center impacts

By LAURA MILLER, Newsletter editor

One Leopold Center hallmark is its long-running competitive grants program. New grants are announced each January and investigators begin their research. When the experiments are finished, or the projects and demonstrations are over, investigators write final reports, which are summarized and published. End of story, and on to the next project, right?

Wrong. The real question is whether funded projects made a difference.

Results of an evaluation conducted over the past two years show the tremendous impacts and influence of Leopold Center support for six long-term projects. This investment has been used to leverage millions of additional dollars for similar work; bring thousands of acres under effective conservation practices; help more than 1,000 farmers profit or change their practices; engage a variety of public, private and civic sector organizational partners; and enhance Iowa State University research programs.

"For every dollar the Leopold Center spent on these six projects, an additional $4.60 was leveraged to complement or expand the work," said Corry Bregendahl, Leopold Center scientist who facilitated the evaluation. "Leopold Center funding, therefore, is seed money that continues to yield additional income and investment in

IMPACTS *(cont. on page 4)*

ISU agronomist to receive Spencer Award

An Iowa State University agronomy professor has been chosen as the 2013 recipient of the Spencer Award for Sustainable Agriculture. Matt Liebman, who holds the Henry A. Wallace Chair for Sustainable Agriculture, will receive the award during the December meeting of the Leopold Center Advisory Board.

Liebman is the first researcher to be honored with the Spencer Award, which has been presented annually since 2002. The award recognizes farmers, teachers and researchers who have made significant contributions to the ecological and economic stability of Iowa's family farms. It includes a $1,000 cash prize from an endowment from the family of Norman and Margaretha Spencer, who farmed near Sioux City for 40 years.

Liebman conducts nationally recognized cropping systems research at the ISU Marsden Farm. His Low-Input High-Diversity project has found that longer rotations with alfalfa, small grains and a red clover cover crop can result in higher yields, lower energy and chemical use, and economic returns comparable to conventional corn-soybean rotations. He also is a member of the prairie conservation strips research team at Neal Smith National Wildlife Refuge near Prairie City and a team studying sustainable cropping systems for biofuels. The Leopold Center supports all three research programs.

"Dr. Liebman is the lifeblood of the sustainable agriculture community at Iowa State University, a key actor within the state of Iowa, and widely recognized at the national level," said Lisa Schulte Moore,

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LEOPOLD CENTER

The newsletter is on the web at:
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LEOPOLD LETTER MISSION

The mission of the *Leopold Letter* is to inform diverse audiences about Leopold Center programs and activities; to encourage increased interest in and use of sustainable farming practices and market opportunities for sustainable products; and to stimulate public discussion about sustainable agriculture in Iowa and the nation.

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The Leopold Center for Sustainable Agriculture seeks to identify and reduce adverse socioeconomic and environmental impacts of farming practices, develop profitable farming systems that conserve natural resources, and create educational programs with the ISU Extension Service. It was founded by the 1987 Iowa Groundwater Protection Act. The *Leopold Letter* is available free from the Leopold Center at 209 Curtiss Hall, Iowa State University, Ames, Iowa 50011-1050; (515) 294-3711.

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News & Notes

The Leopold Center received 47 submissions in response to its Request for Pre-proposals to fund new competitive grants in 2014. After review by the Leopold Center Advisory Board and staff, investigators associated with 27 projects have been asked to submit full proposals by October 29. Funding decisions are made by early January for projects that will begin in 2014.

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The Leopold Center Advisory Board elected new officers at its quarterly meeting in September. Keith Summerville, associate dean at Drake University, will serve as chair, with Polk County farmer Aaron Heley Lehman as vice-chair. Dan Frieberg, who co-owns and manages an agricultural consulting firm based in West Des Moines, will serve as member-at-large.

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The Leopold Center has updated its popular *Food Facts*. This publication offers key findings from 52 research projects either supported by a Leopold Center grant or conducted in-house by staff or working groups since 2000. Topics include community-based food systems, organic and local food, niche meat, and the grape and wine industry. Find it by title on the Leopold Center website, **www.leopold.iastate.edu/pubs/alpha**.

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The Iowa Valley Food Co-op connects 68 producer members with more than 300 consumer members in the Cedar Rapids and Iowa City regions. Its formation was supported by a Leopold Center Marketing and Food Systems Initiative grant in 2011. Co-op planners documented their efforts in a new case study, *Starting an Online Local Food Co-op*, available by title at: **www.leopold.iastate.edu/pubs/alpha**.

Research Results

On the web: **www.leopold.iastate.edu/news/results**

Scientific Journals

Leopold Center-supported research has produced these papers published in peer-reviewed journals. Check at a research library or the journal's website for an abstract of full report. Additional information is available on each competitive grant (see ID number in brackets).

- Flora, Cornelia Butler and Corene Bregendahl (2012). Collaborative Community-supported Agriculture: Balancing community capitals for producers and consumers. *International Journal of Sociology of Agriculture and Food* 19(3): 329-346.

  This research looked at relationships in Community-Supported Agriculture (CSA) enterprises and the "multiple goods" received by consumers as well as producers. The project led to changes in a successful Story County-based CSA, and showed how CSAs can be incubators for new farm businesses. [2005-M01]

- Asbjornsen, Heidi, V. Hernandez-Santana, M. Liebman, J. Bayala, J. Chen, M. Helmers, C.K. Ong and L.A. Schulte (2013). Targeting perennial vegetation in agricultural landscapes for enhancing ecosystem services, *Renewable Agriculture and Food Systems* doi:10.1017/S1742170512000385

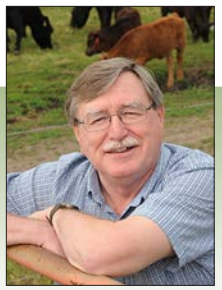
  This paper reviews science evidence that supports the role of perennial plants in balancing conservation with agricultural production. It identifies opportunities and knowledge gaps related to purposefully integrating perennial vegetation into agroecosystems as a management tool for maximizing multiple benefits to society. [2004-E14] [ESP2009-01]

- Manatt, R.K., A. Hallam, L.A. Schulte, E.A. Heaton, T. Gunther, R.B. Hall and K.J. Moore (2013 in press). Farm-scale costs and returns for second-generation bioenergy cropping systems in the U.S. Corn Belt. *Environmental Research Letters*.

  This research is conducted by the Landscape Biomass Research Teams at ISU, also supported by the Leopold Center. The authors analyzed farm-gate costs and returns of five potential biofuel feedstock systems and found that a novel triticale–hybrid aspen intercropping system had the highest yields but still could not compete with corn profitability. Recommendations for improving cost competitiveness were made. [E2010-10] [E2012-11]

Conversations

WITH DIRECTOR MARK RASMUSSEN



Dick Thompson: A reflection on his legacy

I've met a lot of people since returning to Ames. But one person I never got back to – and wish that I had – was Dick Thompson, who died August 17 at the age of 81. A long-time Boone County farmer, Dick helped create Practical Farmers of Iowa. More importantly, he always kept an open mind and tried out many ideas in his own operation. He was the type of farmer Iowa can be proud to have nutured.

He believed that livestock were essential for a sustainable agriculture. As a tribute, we share this essay he and his wife wrote in 2004 (the same vear we honored him with the Spencer Award for Sustainable Agriculture).

Mark Rasmussen

Restore the balance of crops and livestock

By DICK and SHARON THOMPSON, with ROBERT KARP

Is it possible that a farm is not really a farm without a balance and integration of soil, crops, livestock and family?

Is it possible that we tamper with a wise and intelligent order of things when we separate out the crops from the livestock as we have in recent years?

Think about it.

Since we lost the cow—since we lost animals and livestock as an integrated part of the farm—the fabric of rural life has been steadily unraveling.

When we lost the cow, we stopped planting oats and hay, we lost our crop rotations, and we lost the best source of our soil fertility—animal manures. We gained costly inputs, eroding soils and impaired waters.

When we lost our animals, we turned our grass, our pastures and our meadows over to row crops. We gained lower grain prices, greater weed and pest pressure and a less diverse and resilient landscape.

When we lost our livestock, we lost much of the hard work of the farmer, we lost chores for the kids, and we lost a cooperative spirit with our neighbors. We gained outside jobs, aimless youth and the need to gobble up our neighbors' farms to stay in business.

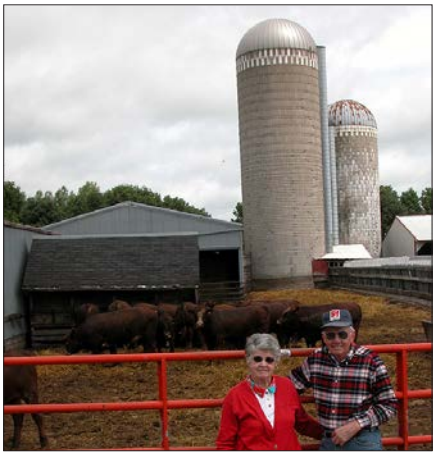
When we lost the balance of crops and livestock, we lost a farm that needed a whole family to work together. We gained farms that could be run by one person and lots of equipment. We gained boredom and fragmentation of the family.

When we concentrated the livestock, farms began to struggle economically, we began to lose more and more farms, and we lost the vitality of our small communities. We gained boarded up main streets, empty churches and consolidated schools.

When I was a boy I attended Jordan school, one of three in the Boone area. After we lost the cows—and the chickens and the pigs, and the goats and the lambs —those three schools consolidated into the United Community School District. Now we are told there are not enough kids for United, so it may need to close too. Some people think we need one school per county.

In our push to get bigger and better, and make life easier physically, we have changed the physical anguish of the past into the mental anguish of the present day. This kind of stress plays an important role in our modern day diseases, such as heart trouble, cancer, arthritis and so on.

This over-aggressive competition does not build good relationships with other people. The situation is typified in bidding against your neighbor and paying $4,250 per acre for additional land, or trying to cash rent land for $175 per acre, or painting cattle in order to win a prize. What a farmer won't do to beat his neighbor by one bushel an acre! This kind of lifestyle is violent and exploits our inner being, our fellow man, and last, but not least, our environment.



Balanced, integrated and sustainable farming practices are the only common sense solution to the problems facing agriculture. If we don't make this approach the foundation of agriculture, no amount of value-added products or farm subsidies will save our farms, no amount of regulations or buffer strips will save our environment, and no amount of positive thinking or economic development will save our rural communities.

Today we have information and technology overload, which has brought on new problems we are trying to solve without considering the human dimension. Commodities do not make communities; it takes people to make communities. We are going to have to learn to say no and learn how to sort the good technology from the bad. Instead of talking about a higher standard of living, we need to learn a new term: appropriate living.

This calls for a change in lifestyle, a change that starts in the heart. A healthy heart—and mind—is necessary before we can have a healthy agriculture. Now is the time to change our priorities. Now is the time to listen to a different drummer. Now is the time to give to the land rather than take from the land.

It's not about going backwards; it's about going forward with greater wisdom—the wisdom of soil, crops, livestock and family integrated and in balance.

EVALUATING PROJECTS

IMPACTS *(continued from page 1)*

the state of Iowa."

The evaluation covered these six projects that had received several years of funding from the Leopold Center:

- **Low-Input High-Diversity Systems** Performance comparisons of conventional and diverse crop rotation systems conducted by ISU agronomy professor Matt Liebman
- **Long-Term Agroecological Research** Comparison of organic and conventional agriculture and cropping conducted by ISU agronomy and horticulture professor Kathleen Delate
- **Hoop Houses for Alternative Hog Production** Comparison of hoop structures versus conventional facilities for livestock production (also known as the Hoop Group) led by Mark Honeyman
- **Regional Food Systems Working Group** Engaging diverse value chain partners statewide in regional food systems development
- **Bear Creek Buffer Project** Working with landowners to mitigate detrimental effects of agriculture on the landscape by installing a chain of riparian buffers led by Dick Schultz and Tom Isenhart
- **Practical Farmers of Iowa** Connecting Iowa farmers with PFI staff and researchers to conduct on-farm research and demonstration based on farmer-identified priorities

Bregendahl worked with graduate student Laura Kleiman, now a research associate at the Leopold Center, to document the impacts of these projects based on project reports, information from Center archives, and interviews with project investigators and key personnel. They also compiled a list of partners, scientific goals and findings, personnel supported, products generated, leverage and future opportunities for each project.

These six projects together have garnered 22 percent of Leopold Center grant funding in the past 10 years. Here is a summary of the quantitative results from the evaluation:

- The Leopold Center invested $3,873,884 in the six projects. Together, these projects leveraged an additional $17,911,553, or $4.60 for every $1 spent by the Leopold Center.
- 22,500 acres were shifted to more efficient conservation regimes (i.e., riparian buffers to reduce nitrate runoff and soil erosion and to improve water quality and wildlife habitat).
- 51,277 individuals participated in project-related outreach activities, 12,932 (25 percent) of whom were farmers and agricultural professionals.
- 1,078 farmers either profited or changed their farming practices to implement conservation measures as a result of these projects, accounting for more than 100 farmers per year.
- 121 key public, private and civic sector organization partners were or are still involved in the work of these projects (individual partners were not counted).
- 255 ISU-affiliated individuals were supported by these projects, or 25 per year (132 undergraduates, 55 graduate students, 39 faculty members, and 29 visiting professors).

"This evaluation is a tentative first step toward a longer journey of determining what difference Leopold Center funding has made in the state of Iowa," said Bregendahl. "I want to emphasize that these were six projects out of 500 funded so they represent just a small sliver of the impact pie."

Bregendahl has led numerous evaluations of other projects at Iowa State University and currently is principal evaluator for the W.K. Kellogg-funded program in Iowa, the NE Iowa Food and Fitness Initiative. She said the rewarding part of the Leopold Center evaluation was to systematically collect data on the same indicators for each project that relate to a critical trio: the environment, the economy and the human element, the "three legs of the sustainability stool."

"Examining impact on a project-by-project basis alone fails to teach us about our collective impact and it's the impact we are having across the state among our different partners and constituents that matters," Bregendahl said. "The numbers we were able to measure AND report, although impressive in their own right, pale in comparison to the actual impacts we have made, but have yet to measure."

www.leopold.iastate.edu

Two-page briefs about each of the long-term projects on a new Leopold Center web page, *Signs of Change*: **www.leopold.iastate.edu/change**

LEADERSHIP RECOGNITION

SPENCER *(continued from page 1)*

the ISU professor who nominated him for the award.

Earlier this year, Practical Farmers of Iowa gave Liebman its 2013 Sustainable Agriculture Achievement Award to recognize his leadership in sustainable agriculture. Writes PFI executive director Teresa Opheim in a letter of support: "His research on the performance of a diversified rotation has been especially important for our member farmers; as it proves their own observations about the economic stability these rotations provide their farm business."

The presentation will be 1:30 p.m. December 5 at the ISU Alumni Center in Ames.

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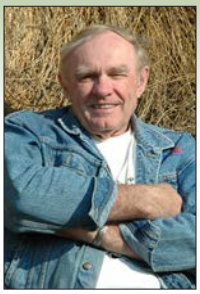
Spencer Award on the website: **www.leopold.iastate.edu/spencer-award**

These are Liebman's research plots at the ISU Marsden Farm west of Ames, where he has 10 years of comparative data for three different cropping rotations.



TOWARD A SUSTAINABLE Future

What really drives science?

Acting on the basis of ignorance, paradoxically, requires one to know things, remember things—for instance, that failure is possible, that error is possible, that second chances are desirable (so don't risk everything on the first chance) and so on.—Wes Jackson

Stuart Firestein, who chairs the Department of Biology at Columbia University, has written a new and insightful book, *Ignorance – How It Drives Science*. He reminds us that our current paradigm tends to view science as a "brotherhood tied together by its golden rule, ***the Scientific Method***, an immutable set of precepts for devising experiments that churn out the cold, hard facts." In other words "sound science" provides us with indisputable certainty.

Firestein argues, however, that this is *not* how science works. Science is actually driven not by what we **know**, but by what we **don't know**. From his book: "It's not facts and rules. It's black cats in dark rooms" … "It's groping and probing and poking, and some bumbling and bungling, and then a switch is discovered, often by accident, and the light is lit, and everyone says, 'Oh, wow, so that's how it looks,' and then it's off into the next dark room." (Firestein, 2012)

This suggests, as Alfred North Whitehead, Michael Polanyi and other scientists have long told us, that science is a **process, not an accumulation of incontrovertible facts**. Every time science discovers a black cat in a dark room, it uncovers more black cats.

This insight is important for agricultural sciences, especially at this time in history. It is commonplace to see statements such as, "this is based on sound science," or "we know" that such and such is true—implying, of course, that the black cat we learned about yesterday has settled matters, so we no longer need further explorations. Firestein says that past discovery always opens doors to additional "black cats," which then drive science to the next discovery. This is the way science works.

I think Firestein's ignorance-based science should inform agriculture—although it often doesn't. Numerous examples could be cited, but let me use just one. When the agricultural sciences discovered that pest pressures in monocultures could be addressed by inventing and applying pesticides, we assumed "sound science" had solved the problem. Instead, we should have used that moment to investigate the other black cats in the room: What if pests become resistant to pesticides? What if the pesticides get into our food and water? What if the pesticides affect soil microorganisms, and what impact would that have on soil biology? Are there other ways to address pest problems?

Unfortunately, science as "process" is not how science is used in agriculture today. More often we seem to use our limited resources to defend the cats that already have been discovered rather than to look for more black cats. Using past discoveries to claim that we already "know" something leads science into the role of preventing—rather than driving—additional discoveries.

In a coda to his book, Firestein makes another important suggestion. He proposes that the sciences invite public citizens to be "in the know" **with** scientists to become part of the conversation and process. Since we are all part of the mystery of what we don't know, we need to make the conversation more inclusive. Failure to do so limits our creativity. Firestein believes that "this can be changed by introducing into the public discourse explanations of science that emphasize the unknown."

In other words, instead of trying to convince the public that we already "know" all we need to know to solve the problems of our food and agriculture enterprises (especially as we face incredible new challenges in our future), we should inform the public about the many black cats that are still out there. Such an approach would emphasize the unknown, the puzzles still waiting to be solved, which could create opportunities for innovative conversations.

This is intriguing advice. It also may be a way of moving us beyond the food fights that so often dominate and cripple our public discourse in the agricultural sciences. Rather than insisting that *our* food system is the **right** one, we could learn to talk in public about "what we don't know." We might find ourselves in a crash course on **citizen science** that could be immensely productive to address the problems we face with current and future food systems.

I offer just one caveat. In today's culture, largely dominated by our assumptions that we already "know" what we need to know, we may tend to equate ignorance with stupidity. Once we begin to realize that scientists don't "know" everything, but are on bungling journeys of constant exploration, we may be tempted to give up on science. It might be time to redefine stupidity, perhaps it's more like Einstein's definition of insanity: "doing the same thing over and over again and expecting different results."

The way of ignorance is simply the way of humility—it is a way that drives us to constantly explore, to be open to surprises and new revelations. What is truly stupid is asserting that we already "know" when we are, in fact, on a constant journey of learning.

Wendell Berry reminds us that none of this suggests that "we recommend or praise" ignorance. Instead, we recognize that "our ignorance ultimately is irremediable … The extent of our knowledge will always be, at the same time, the measure of the extent of our ignorance." (Berry, 2005)

Find extended essay and list of references on the web:
www.leopold.iastate.edu/content/writings-fred-kirschenmann

Research gives insights into managing corn for nitrogen capture

By MELISSA LAMBERTON, Special to the Leopold Center

One of the Leopold Center's earliest investments, an extensive water quality monitoring system at an Iowa State University research farm, now offers insights into an issue of growing concern: how to manage croplands for better nitrogen capture.

A research team led by Matthew Helmers, ISU Agricultural and Biosystems Engineering, evaluated how several current trends in Iowa agriculture can influence water quality, including the use of continuous corn systems, stover removal for biofuel, and the emphasis on no-till and cover crops as conservation practices. Helmers has received competitive grant funding from the Center's Cross-Cutting and Ecology initiatives.

The project began in fall 2006 at ISU's Northeast Iowa Research and Demonstration Farm near Nashua, where a state-of-the-art water quality monitoring system was installed in 1988 with Leopold Center support. Helmers has received competitive grant funding from the Center's Cross-Cutting and Ecology initiatives.

As acres of corn and soybean fields await harvest this fall, an invisible process is taking place underground, where a network of drainage pipes funnel excess water away from cropland and into nearby waterways. These tile lines, installed in the late 19th and early 20th centuries, carry nutrients to streams and rivers in the Mississippi River watershed. Those nutrients contribute to poor water quality and the growing hypoxic zone in the Gulf of Mexico, an area of low oxygen where marine life cannot survive.

Farm management practices can play a major role in controlling nitrogen loss, according to Helmers. His study site, comprised of 36 one-acre plots, has amassed more than two decades of records on tillage and cropping practices. A system of underground drainage lines can isolate water samples from each plot, proportionate to the amount of flow, which researchers collect for analysis.

The data showed that corn-soybean fields lost less nitrogen to drainage water than did continuous corn plots. Stover removal and the use of no-till had little impact on water quality. However, planting a cover crop significantly reduced nitrogen loss, as did applying swine manure only before the corn rotation rather than before both corn and soybean.

Overall, the treatment that proved most effective at capturing nitrogen was a corn-soybean system with a winter rye cover crop and spring-applied UAN fertilizer. Under the corn rotation, this treatment delivered approximately 25 percent less nitrogen to drainage water compared to a similar treatment with no cover crop, and 50 percent less nitrogen compared to the continuous corn system with no cover crop (based on averages, 2007-2011).

"Cover crops really do have on-the-ground potential to reduce nitrate loss," Helmers said. "It gives us a selling point for producers to consider."

Researchers also tracked yields, which showed no dramatic differences between the treatments.

Learning how to better manage farmland to diminish nitrogen pollution is a goal of the 2012 Iowa Nutrient Reduction Strategy, a science- and technology-based assessment developed in response to the 2008 Gulf Hypoxia Action Plan. "The research that has and continues to be collected at the Nashua site played a prominent role in the non-point source science assessment of the Strategy," Helmers said. "That info was very useful in developing our estimated percent reduction for various practices."

Nearly all the practices evaluated in the reduction plans have some history of research support from the Leopold Center, including denitrifying bioreactors, riparian buffer strips, cover crops and extended crop rotations.

In June 2012, members of the Leopold Center Advisory Board had an opportunity to see the state-of-the-art water quality monitoring system when they attended a board meeting at the farm. At right, Laura Jackson poses a question to research farm superintendent Ken Pecinovsky (left) while Patrick Pease and Susan Jutz listen.

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Managing Cropland: for Nutrient Capture summarizes Nashua research:
www.leopold.iastate.edu/nutrients

Helmers' current project:
www.leopold.iastate.edu/grants/xp2011-04

The Center continues to support the research at the Nashua site through its competitive grants program. A current grant led by ISU researchers Michelle Soupir, Michael Thompson and Helmers, extends the water-monitoring project to consider the emerging issue of antibiotic-resistant pathogens (see page 7 for details). In addition to setting up the research site in 1988, the Leopold Center supported research to evaluate denitrifying bioreactors (2009-2012) and the impacts of various manure management practices on water quality (1990-2003).

The water quality monitoring system built with Leopold Center funds is at the ISU Northeast Research Center near Nashua.

New study investigates bacteria movement in the environment

By GEETHA IYER, Leopold Center Graduate Communications Research Assistant

On a sunny day at a research farm in northern Iowa, scientist Michelle Soupir considers her data source—a cow pie freshly deposited on rain-drizzled grass. A soil and water quality researcher at Iowa State University, Soupir is interested in how gut bacteria from livestock survive and move from manure on the field into nearby water bodies like streams and lakes.

"We would like to see manure applications to land," Soupir says in a new On the Ground video from the Leopold Center. "It's a great organic source of fertilizer." But some of the gut bacteria found in manure have the potential to cause disease in humans if they wash into waterways after rainfall. "By better understanding the movement of bacteria," Soupir says, "we can help to prevent that."

Funded by a three-year competitive grant from the Ecology Initiative in 2012, Soupir's project looks at two different sources of manure—cows and hogs. Her lab collects samples of cow pies to study how many bacteria are present and whether they are attached to smaller or larger sized manure particles—smaller particles are transported farther with runoff.

"We would like to see animals integrated into pastureland and back into the landscape," says Soupir. Management of bacterial transport may be something as simple keeping grazing animals further from flowing waterways. Bacteria survival and transport also are decreased as the cow pie dries up. But this is not the only means of manure application.

Swine operations are another important source of fertilizer, which is injected in the form of liquid in bands in crop fields. Soupir's swine manure studies involve sampling from various locations on and off a field site near Nashua. Her lab collects soil from along and between the manure application bands on the field, and water samples from the adjacent tile line. These samples are tested for bacterial content, but also specifically for antibiotic-resistant bacteria. The swine portion of her study also is supported by the National Pork Board.

"Antibiotics are very important to our current agricultural production systems," Soupir says. She goes on to explain that while frequent low doses of antibiotics promote the overall health and growth of livestock in a swine operation, it also means that some of the gut bacteria in swine manure have evolved resistance to those antibiotics—they can no longer be killed by that antimicrobial agent.

"Many of the antibiotics we use in agriculture are similar [to the ones] that are used to treat humans," Soupir says. This reduces our disease treatment options if people are exposed to antibiotic-resistant bacteria in manure that runs off into waterways. "So we need to be careful with the antibiotics we have available … for both the treatment of animals and humans."

"I think of a sustainable system as having an integrated crop and livestock system in place," Soupir says, and bacteria are part of that system. Understanding how bacteria survive and move from livestock to soil to stream will help scientists like Soupir limit bacterial transport into water bodies by designing better and more effective conservation practices.

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On the Ground video:
www.leopold.iastate.edu/news/on-the-ground/gut-soil-water-bacterial-transport-through-environment

Soupir displays bacterial cultures taken from the field and grown in her lab. The bacteria are identified, counted and tested for resistance to antibiotics.

Ross Tuttle, an ISU graduate student in civil engineering, collects a water sample from the drainage at a Nashua experimental plot. Soupir's graduate and undergraduate research assistants collect manure, soil and water samples periodically from various locations at the field sites. This helps determine bacterial transport on both spatial and temporal levels.

You pick, then I pick – Machinery sharing on fruit and vegetable farms

By GEETHA IYER, Leopold Center Graduate Communications Research Assistant

This fall researchers from Iowa State University are tracking how eight farmers in southwest Iowa shuttle a harvester among their farms during aronia berry season. The challenge—the berries must be picked within a two day time frame, and the farms are spread across 40 miles.

"It will be interesting to see how they work that out," says Georgeanne Artz, assistant professor at ISU's Department of Economics. Artz's research project looks at how small to mid-sized fruit and vegetable farming operations negotiate machinery sharing, to provide examples of how others might adopt such an arrangement.

Funded by a one-year Marketing and Food Systems grant in 2013, the project addresses growing interest from fruit and vegetable growers in expanding their operations in a cost- and labor-efficient manner. "Is it possible," Artz asks, "for growers to get access to a piece of machinery without owning it outright—if they share it with others? How does that work?"

To answer these questions, Artz and her research team are interviewing six groups of farmers who have entered into trial sharing agreements this year. Apart from the aronia berry harvester, there are groups sharing an ECO weeder, a transplanter, a mulch remover, a garlic separator, and a multipurpose toolbar attachment for the back of a tractor.

Each group has drawn up its own operating agreement, which stipulates when each member gets the equipment, how to move it between farms, what happens if someone breaks the machine, or what to do if someone wants to back out of the sharing scheme altogether. Artz's team will collect copies of these agreements, as well as information on how the farmers communicate with each other, their individual management styles, planting and harvesting regimes, and details on how labor, time and expenditure are influenced by the sharing scheme.

Artz expects a variety of results. For instance, while weeding might be done several times during the season, the garlic separator will be needed only once, and this influences how many people can share the equipment, how far apart their farms might be, and whether it is more or less effort to share than to go it alone. She hopes to turn these six groups' experiences into case studies on machinery sharing, to use in university extension and outreach materials, and in publications and talks.

"We want to give people the idea that there's not a right way, there's lots of different ways [to share equipment]," says Artz. "You have to figure out what works for you."

This is not just economics by numbers—case studies, sample operating agreements and worksheets detailing practical considerations provide tangible examples to farmers of whether machinery sharing is a feasible practice for their own operations.

"Teaching with case studies or stories or examples helps people relate better to the information that you're trying to give them," explains Artz. "You can say, "Here are the things you need to think about," or illustrate them based on somebody else's experience. It's a lot more meaningful."

Farm equipment sharing is not a new phenomenon. Artz explains that in the early 1990s row-crop farmers trying to stay in business shared both machinery and labor. A Leopold Center project studying this practice developed a manual on machinery sharing for corn and soybean systems—something that was of interest to fruit and vegetable growers.

A trending demand for local foods encourages fruit and vegetable growers, whose demographics include new and beginning farmers as well as traditional farmers wishing to diversify their row crop operations. But the revenue from such produce is still relatively small and labor demands are high, particularly for tasks such as weeding or fruit picking for retail purposes. This is why a small farm might consider sharing equipment to maximize productivity.

Artz speculates on what might happen next, explaining that while fruit and vegetable farms account for a tiny fraction of production in the state, "they are fast growing from a small base." She points out that smaller farms face many challenges and wonders whether the experience of machinery sharing may lead to other forms of cooperation, such as buying inputs together, or marketing produce together in cooperatives.

"Start simple, learn how to work together," says Artz. "[and] maybe this is a foundation on which people might build relationships that leads to other things."

Right: A farmer demonstrates the use of the ECO weeder, which attaches to the back of a tractor.

Bottom: The aronia berry harvester at work. Timing is essential – the farmers must make sure that a maximum number of berries are ripe. Says Artz, "Harvesting is a really hard thing to mechanize, especially if you're selling for retail, because you want the product to look beautiful."

Study estimates cost for new conservation practice

Prairie conservation strips interlaced with row crops could be one of the most cost-effective and low-effort conservation practices available to farmers and landowners in the Midwest.

According to research from the ISU STRIPs team (Science-based Trials of Rowcrops Integrated with Prairies), converting one tenth of a row-cropped field to perennial prairie could result in a reduction of more than 90 percent in soil and nutrient runoff from the entire field. A new economic analysis shows that the average cost to treat runoff from an acre of corn or soybeans is just $24 to $35 per year.

The analysis was conducted by John Tyndall, a member of the STRIPs team and ISU assistant professor in Natural Resource Ecology and Management. The cost is spread over a 15-year land management regime. Tyndall's estimate includes the cost of land conversion, maintenance and the "opportunity cost" of lost revenue or rent from acreage taken out of crop production. More than 90 percent of the total cost is the opportunity cost, which can be offset if the land is enrolled in federal conservation programs such as the Environmental Quality Incentive Program or Conservation Reserve Program.

www.leopold.iastate.edu

The Cost of Prairie Conservation Strips is listed by title:
www.leopold.iastate.edu/news/pubs/alpha

Visit the STRIPs website:
www.prairiestrips.org

How Tyndall estimated these costs and ranges (representing different land values) is outlined in a new publication, "The Cost of Prairie Conservation Strips." available on the Leopold Center website and the STRIPs website.

The Leopold Center is supporting this research.

Research update: Attracting native pollinators

Earlier this year, we reported results of a three-year study by Iowa State entomologist Matt O'Neal ("Researchers zoom in on best flower mix for beneficial insects," Spring 2013 *Leopold Letter*).

He found that a variety of prairie plants in field buffers at four ISU research farms increased the number of pollinators—both honey bees and solitary native bees—compared to single-species buffers of switch grass, alfalfa or willow. Buffers with just two types of prairie plants—early-blooming meadow zizias and late-blooming asters—made a difference by providing food (nectar and pollen) for these important pollinators throughout the season.

O'Neal is working with post-doctorate researcher Thelma Heidel-Baker under a two-year grant from the Leopold Center's Cross-Cutting Initiative. This summer she put artificial nests in the buffers to provide over-wintering habitat for stem-nesting bees. The simple structures were made from a section of plastic pipe open at one end and filled with paper straws.

"Despite the lack of existing nesting sites, we found evidence of bees using our artificial nests," O'Neal said. "We are identifying the bees captured at the sites to determine if the nests increased the presence of stem-nesting bees. Next year we will explore what makes the best material for these nests."

Undisturbed soil is important to bee species that nest in the ground. O'Neal has identified more than 20 species of native bees in the buffers as well as the surrounding crop fields. The study looks at the impact of buffers and the presence of pollinators on yields of adjoining fruit and vegetable crops. But O'Neal's also found about 20 species of native pollinators in fields of self-pollinated crops, and is looking at how they attract beneficial insects (such as ladybugs) that are natural enemies of crop pests.

Pollinator health continues to be a national concern. In May, the U.S. Department of Agriculture and U.S. Environmental Protection Agency released a comprehensive report showing that multiple factors play a role in the decline of honey bee colonies. Scientists estimate the annual value of pollination services to U.S. agriculture is around $20 billion, about one-third from native species.

Researchers mounted a section of plastic pipe 3-4 ft. above the ground to provide nesting spots for native bees. The pipes are closed on one end and filled with paper straws.

Iowa Learning Farms launches statewide youth program, Water Rocks!

What do rubber ducks, dogs, pirates, poop and poodle skirts have in common? These are all tools being used to promote a new statewide youth awareness campaign called "Water Rocks!".

Water Rocks! delivers entertaining and engaging activities to inspire kids of all ages to appreciate water resources. Through classroom visits, an interactive website, an award-winning computer game, songs, music videos, dogs, enhanced learning activities, public service ads, teacher/peer mentor workshops and geocaching, Water Rocks! offers an unique, light-hearted approach to this important topic.

"It begins and ends with water," explains Jacqueline Comito, Iowa Learning Farms program manager and director of the campaign. "The long-term health of our land and water rests in our youth, the future decision-makers. We use music, science, math, art, video and technology to remind students of the fact that water is elemental to life."

Beginning in early 2012, the Leopold Center provided $50,000 annually for three years to the Iowa Learning Farms (ILF) to enhance and expand its operations. Comito said those funds have been essential for Water Rocks!

"We couldn't have done Water Rocks! without the support of the Leopold Center," she said. "In fact, it has been the Leopold Center partnership that helped fund much of our more innovative educational outreach activities such as the Conservation Station and the video work. The concept of Water Rocks! emerged out of those earlier projects. The great part about working with the Leopold Center is a willingness to fund a creative approach to outreach and education."

ILF, which will celebrate its 10th anniversary in 2014, is a partnership among the Leopold Center, Iowa Department of Agriculture and Land Stewardship, Iowa Department of Natural Resources, the USDA's Natural Resources Conservation Service and Iowa State University Extension and Outreach. ILF's goal has been to create a culture of conservation through workshops, field days and working with farmer partners throughout the state.

In 2010 Iowa Learning Farms introduced a mobile learning center called the Conservation Station. It houses a rainfall simulator to demonstrate the effects of rainfall on undisturbed soils with a variety of soil covers and impervious and porous surfaces. ILF has added two smaller trailers for hands-on conservation and natural resource education, with one serving primarily as an outdoor classroom for youth.

Music

Music is an important part of resources that the team has developed for youth. "Music is elemental to our lives. Something sung is more powerful and easier to remember than spoken word. It triggers our imagination and touches our heart," says Comito, who also is a musician and appears in the videos.

Original music videos on the Water Rocks! website or YouTube channel include "Human Landfills," "Everybody Poops" and "Will U B the H 2 my O?" The website also features audio recordings (and lyrics) of original songs such as "Dino Water," "Shout Out to the Trout" and "Climate Change Remix."

Learning activities

The ILF team has created other types of K-12 learning activities that weave science, technology, engineering and math (STEM) with the arts. Activities include We All Live in A Watershed, Wetland Bingo, Habitat Hopscotch and Creature Cache, among others. A teacher summit is planned for June 2014.

Nature experiences

Water Rocks! encourages Iowans to spend more time outdoors so they can enjoy and learn more about the state's natural areas. One approach has been to create information-filled boxes hidden in 11 state parks for geocache activities. Geocaching uses a GPS device or smart phone to lead participants to treasure boxes, or caches. The Water Rocks! caches have riddles and fun facts about watersheds, water quality and Iowa parks. Coordinates to the caches are on the Water Rocks! website.

Multi-media

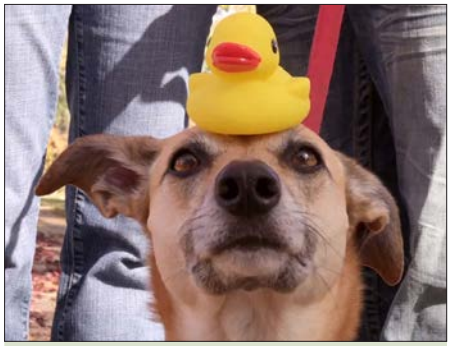
The website also has videos reflecting the affection that Iowans have toward their land and soil, Comito said. "Two of the videos, 'Treasures of Iowa' and 'I am an Iowan,' remind us how wonderful Iowa is and why water quality is important here," she said.

These messages are reinforced in public service advertisements, "What's in your water?"' that will air this fall on WHO and KWWL television stations, as well as on stations affiliated with RadioIowa.

The Water Rocks! team has developed an interactive computer game, "Rock Your Watershed!" On 10 parcels of land within a watershed, players choose combinations of land uses, along with tillage choices and rates of fertilizer to aim for the highest score. The game recently won national honors from the American Society of Agricultural and Biosystems Engineers (ASABE).

All of the videos, songs and the computer game can be found on the Water Rocks! website: **www.waterrocks.org**. New videos and educational materials will be released on a monthly basis starting in September 2013.

water rocks!

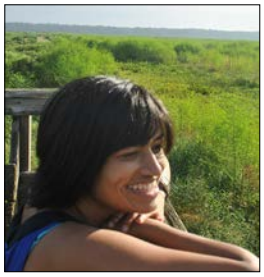


One of the public service ads "What's in your water?" replaces rubber ducks with raindrops so we may see what is in our water more easily.

At a school visit, the Water Rocks! team helps students see the cumulative effect of pollutants and their impacts in a watershed.

Leopold Center gains international insight

Two new staff members at the Leopold Center offer an international insight. **Geetha Iyer** is the new graduate research assistant in communications and grew up in the United Arab Emirates. **Priyanka Jayashankar** is a contributing associate professor in business management from India.



Iyer joined the staff in June to assist in Leopold Center communications, including writing news releases, designing the *Leopold Letter* and other outreach materials, coordinating On the Ground research videos, updating the website and managing the Center's Facebook page. She currently is pursuing a Master of Fine Arts degree in Iowa State's program in Creative Writing and Environment.

She has undergraduate degrees in biology and English from the University of Michigan, and a Master of Forest Resources and Conservation degree from the University of Florida, focusing on forest health and environmental education. While at UF, she worked with a team of forest pathologists and education specialists to develop a curriculum about forest health for middle and high school students that has received national recognition.

In Ames, she has volunteered to work with middle and high school students on creative writing, and is coordinator of the MFA program's Everett Casey Nature Center and Reserve in Boone County.

Jayashankar came to Center in August, under an appointment shared with the ISU College of Business, where she teaches an undergraduate management class. She will conduct research on marketing strategies and value chain development with a focus on local food systems.

She has a Ph.D. in business administration (2012) from the Maastricht School of Management in the Netherlands. As part of her research, she conducted field studies on the social impact of microfinance in southern India and East Africa. Her research interests include marketing strategies for nonprofit organizations, social entrepreneurship, microfinance and value chain development.

Since coming to ISU last year, she has been a guest speaker for the social justice elective in the College of Design and has worked as a research fellow for a Dutch business school developing curriculum materials for an innovative finance course. She also has worked with the international NGO Hand in Hand to launch a social entrepreneurship program that is modeled after a similar project at the Harvard Business School.

She has undergraduate degrees in journalism and economics from India. She worked two years as a journalist for the South Asian financial daily, ***Business Line***, and coordinated a Dutch multinational company's dairy market research project in India.

Superheroes in training

A popular feature on the Leopold Center's Facebook page spotlights the graduate students who crunch numbers, collect data and work in all weathers for the sake of research that just might someday change the world. Here are excerpts from interviews with these "superheroes in training." Complete interviews can be found on Facebook: **www.facebook.com/LeopoldCenter/notes**

Adrienne Gathman, an agricultural law student at Drake University, works with the Sustainable Agriculture and Land Tenure Initiative (SALT). This past summer she researched organization of farmer's markets, zoning ordinances regarding hoop houses and the Iowa Nutrient Reduction Strategy.

I became interested in food and agricultural law because I look at both as a sort of family business. My dad is a general manager of a cooperative, as was his dad, and my mom's family has been farming in northwest Iowa for a couple generations. I always hoped that at some point I would be able to contribute during "shop talk" conversations, and now, I can.

Nicholas Pates worked on developing machinery-sharing arrangements for fruit and vegetable farmers as part of his master's project in economics at Iowa State University (see page 8 for article).

What got me excited was hearing the [farmers'] stories and what their operations meant to them. My dad has been an agricultural journalist for over 30 years and continues to this day. I can remember as a kid being on "on assignment" with Dad, sitting around the kitchen tables of many farmers, listening to Dad conduct his own interviews. Doing my own interviews was a blast from the past. Knowing that the work we were doing would help a passionate community of local growers was a big motivator for me.

Alison King is studying soil science in ISU's Graduate Program in Sustainable Agriculture. She works on cropping systems research led by Matt Liebman (see page 1).

My research focuses on nutrient dynamics in long-rotation cropping systems in Iowa. Specifically, I look below ground to ask how a decade of management history (in short rotation corn/soy or long rotation corn/soy with oats or alfalfa) drives nitrogen through different pools in soil across a growing season. I think it's important to understand what's happening in the soil in these cropping systems because long rotations represent a really important tool for sustainability—they can function with fewer agrichemical inputs and they offer a way for livestock to be re-integrated with the landscape.

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Highlight Events

Learn about how to get support for events: www.leopold.iastate.edu/grants/education

More details, events
Check Leopold Center Web calendar:
www.leopold.iastate.edu/news/calendar

Commercial Fruit and Vegetable Growers Field Day

Brandon Carpenter, a graduate student at ISU's new Sustainable Vegetable Production Lab, explains the use of biochar in a carrot and pepper production system. More than 70 people attended the August field day for commercial growers at the ISU Hort Farm in Ames. The new Sustainable Vegetable Production Lab is supported by a three-year grant from the Leopold Center. It emphasizes strategies that enhance vegetable production and cropping system sustainability by building soil organic matter and improvements in soil quality.

More about the new lab:
www.extension.iastate.edu/vegetablelab

Lectures laud soil quality

Geologist and author David Montgomery presented the 2013 Pesek Colloquium on Sustainable Agriculture September 23 at Iowa State University. The topic reflected his book, *Dirt: The Erosion of Civilizations*.

Soil health guru Ray Archuleta will be in Ames on April 1, 2014 for the next Shivvers Memorial Lecture. Archuleta is a soil scientist for the U.S. Department of Agriculture's Natural Resources Conservation Service and is known widely for his innovative presentations.

4th National Conference for Women in Sustainable Agriculture
November 6-8, Des Moines

The Leopold Center is among the sponsors for the event, coordinated by the Women, Food and Agriculture Network. National keynotes, more than 40 workshops and field tours are planned.

13th Annual Iowa Organic Conference
November 17-18, Iowa City

The University of Iowa will again be the site for the annual Iowa Organic Conference. Keynote speaker is Montana organic farmer Bob Quinn. The Leopold Center is a sponsor of this annual event.